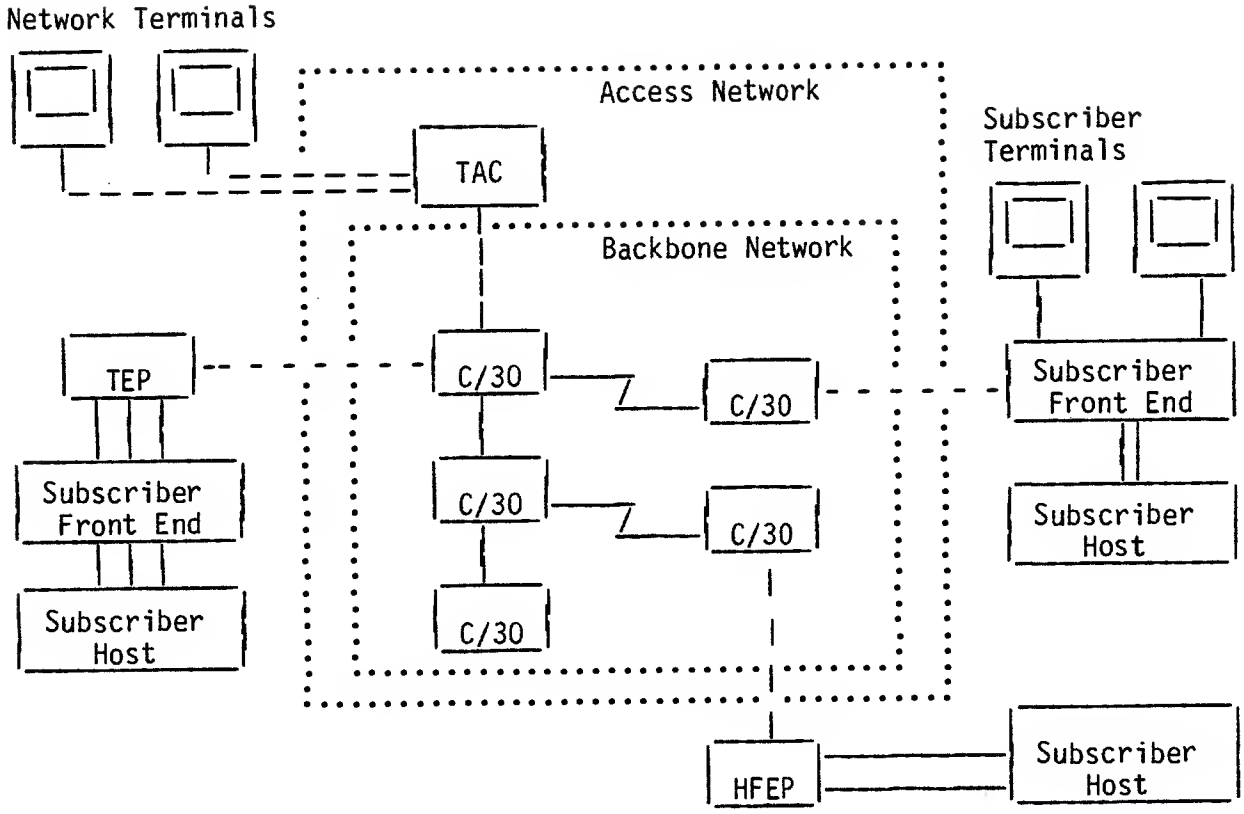
JOHN & DEAN SHOW

DDN/CDCNET OVERVIEW CLASS



C/30 Packet-Switching Node (i.e. IMP - Interface Message Processor

HFEP Host Front End Processor

TAC Terminal Access Controller

TEP Terminal Emulation Processor

Defense Data Network Components

Network Layer Model
Open Systems Interconnect

1 Physical Layer
- Actual Connection between Network Nodes
- Defines Electrical Characteristics of Wire
- Defines Signals and Number of Wires
- E.g. RS232, RS449

2 Data Link Layer
- Synchronizes Sending and Receiving Data Stream
- Breaks Bit Stream into Frames
- Bit Level Error Detection and Recovery
- E.g. HDLC, SDLC (IBM)

3 Network Layer
- Routes Messages from Source to Destination Node
- May Route over Several Network Nodes
- May Route over Several Different Kinds of Networks
- Messages May be Discarded, Out-of-Order, Duplicated, Damaged
- Defines the Addressing Scheme(s)
- E.g. X.25, ARPANET

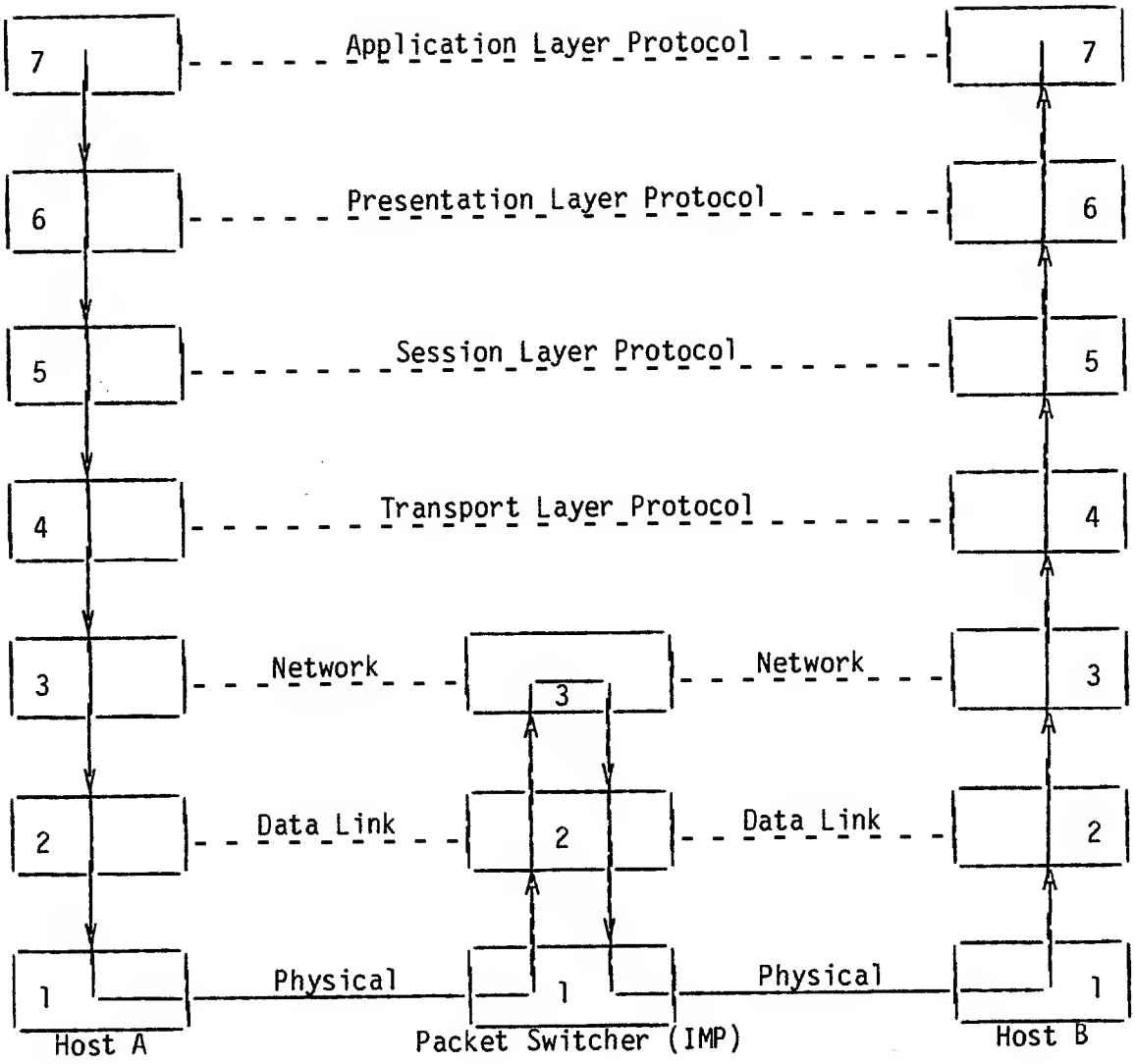
4 Transport Layer
- Provides End-to-End Control of Data
- Connection Oriented
  - Open - Send/Receive - Close
- Data is Ordered and Reliable
- Unaware of Routes Used to Deliver Data
- E.g. Network Access Method (NAM)

Network Layer Model
Open Systems Interconnect

5 Session Layer
- Network Independent Diaglogue Between Users/Applications
- Performs Name/Address Translation
- Provides Session Synchronization and Recovery
- Frequently Combined with Presentation
- E.g. IAF, MFLINK (PTF)

6 Presentation Layer
- Provides Useful Transformations on Data
  - Character Set Conversion
  - Text Compression
  - Encryption
  - Representation Differences (e.g. floating point)
- Frequently Combined with Session
- E.g. IAF, MFLINK

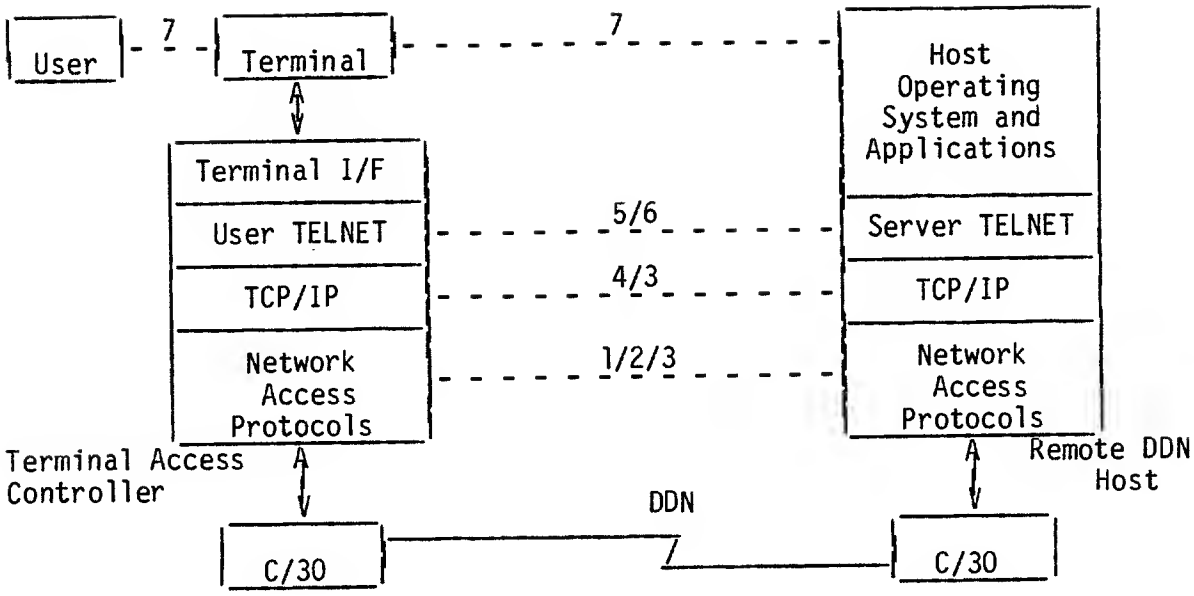
7 Application Layer
- Actual User or Application that Accesses Network Services
- E.g. Terminal User, NOS Control Statement



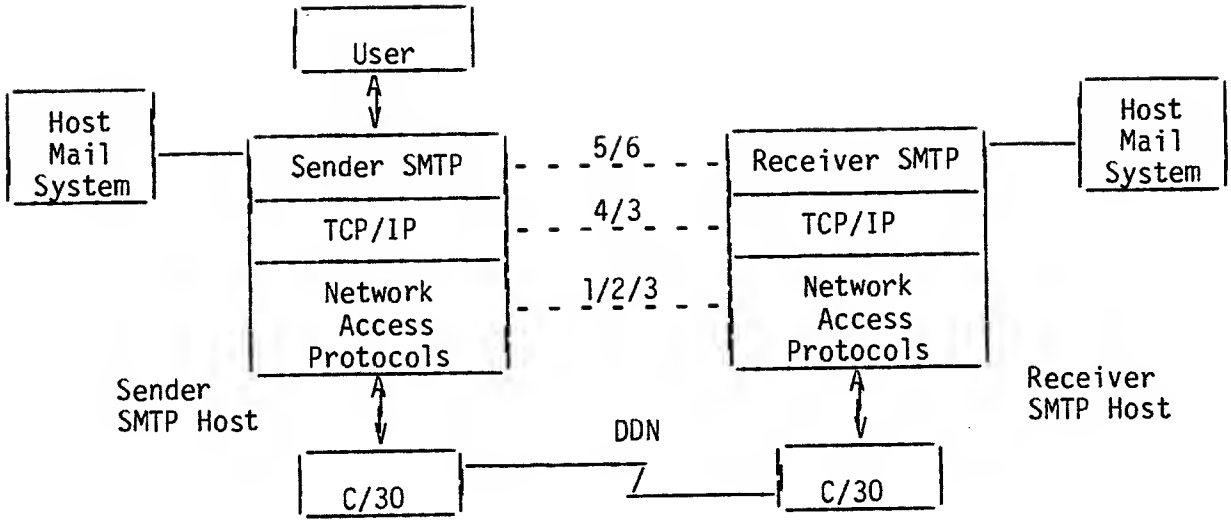
ISO Reference Model

DDN Protocols

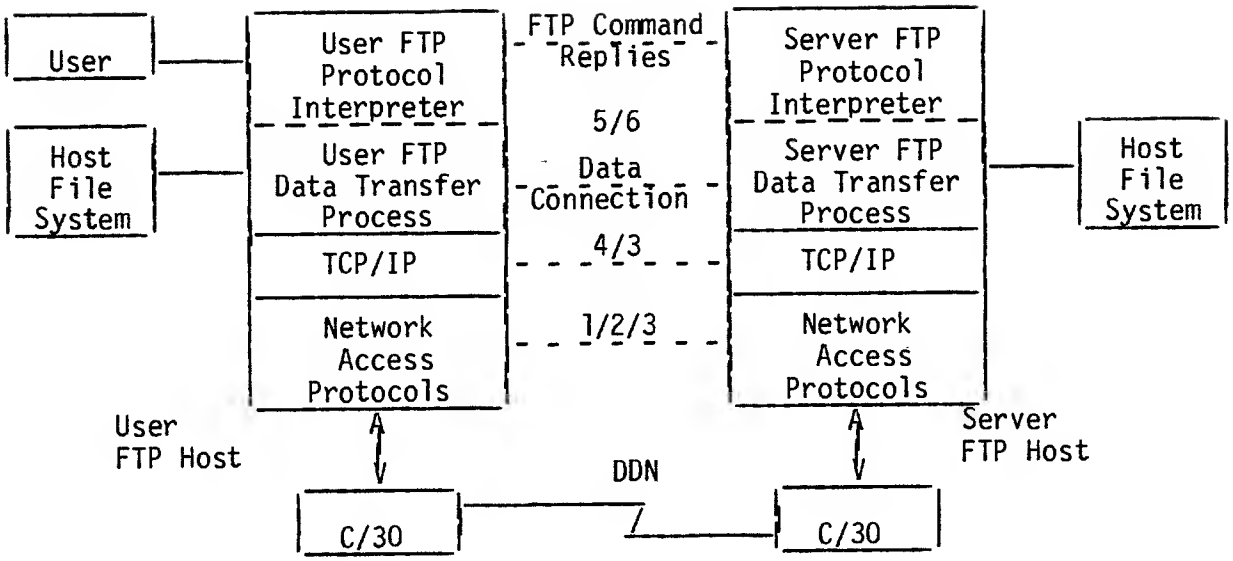
1	Physical	ARPANET 1822, RS232, RS449
2	Data Link	ARPANET 1822, HDLC/LAPB (X.25)
3a	Network	ARPANET 1822, X.25
3b	Network	Internet Protocol (IP)
4	Transport	Transmission Control Protocol (TCP)
5	Session	Three Required Protocols
6	Presentation	File Transfer Protocol (FTP)
		Simple Mail Transfer Protocol (SMTP)
		Terminal Interface (TELNET)



DDN TELNET Protocol Function



DDN Simple Mail Transfer Protocol (SMTP) Function



DDN File Transfer Protocol (FTP) Function

CDCNET Components

DI Basic Device Interface
Cabinet
Power Supply and Cooling
Slots for 8 Large Boards
Slots for 8 Small Boards

MPB Main Processor Board
Primary CPU for a DI
Random-Access Memory, some Battery-Backed.
Read-Only Memory (for bootstrap and diagnostics).

SMM System Memory Module
Primary DI Memory Resources
Accessible by all Boards

PMM Private Memory Module
Fast-Access Memory
Accessible only by MPB

ESCI Ethernet Serial Channel Interface
Provides interface to Ethernet Transceiver
MC68000 Processor, plus special Ethernet chips

MCI Mainframe Channel Interface
Provides interface to CYBER I/O Channel
MC68000 Processor, plus channel interface circuits

LIM Line Interface Module
Small Boards
Provides interface to terminals and other standard lines
E.g. RS232, RS449, V21.

CIM Communications Interface Module
Controls up to 8 Line Interface Modules

Device Interface Types

MDI Mainfram Device Interface

Provides CYBER Mainframe Connection to CDCNET.

- MPB Main Processor Board
- SMM System Memory Module
- PMM Private Memory Module
- ESCI Ethernet Serial Channel Interface
- MCI Mainfram Channel Interface

TDI Terminal Device Interface

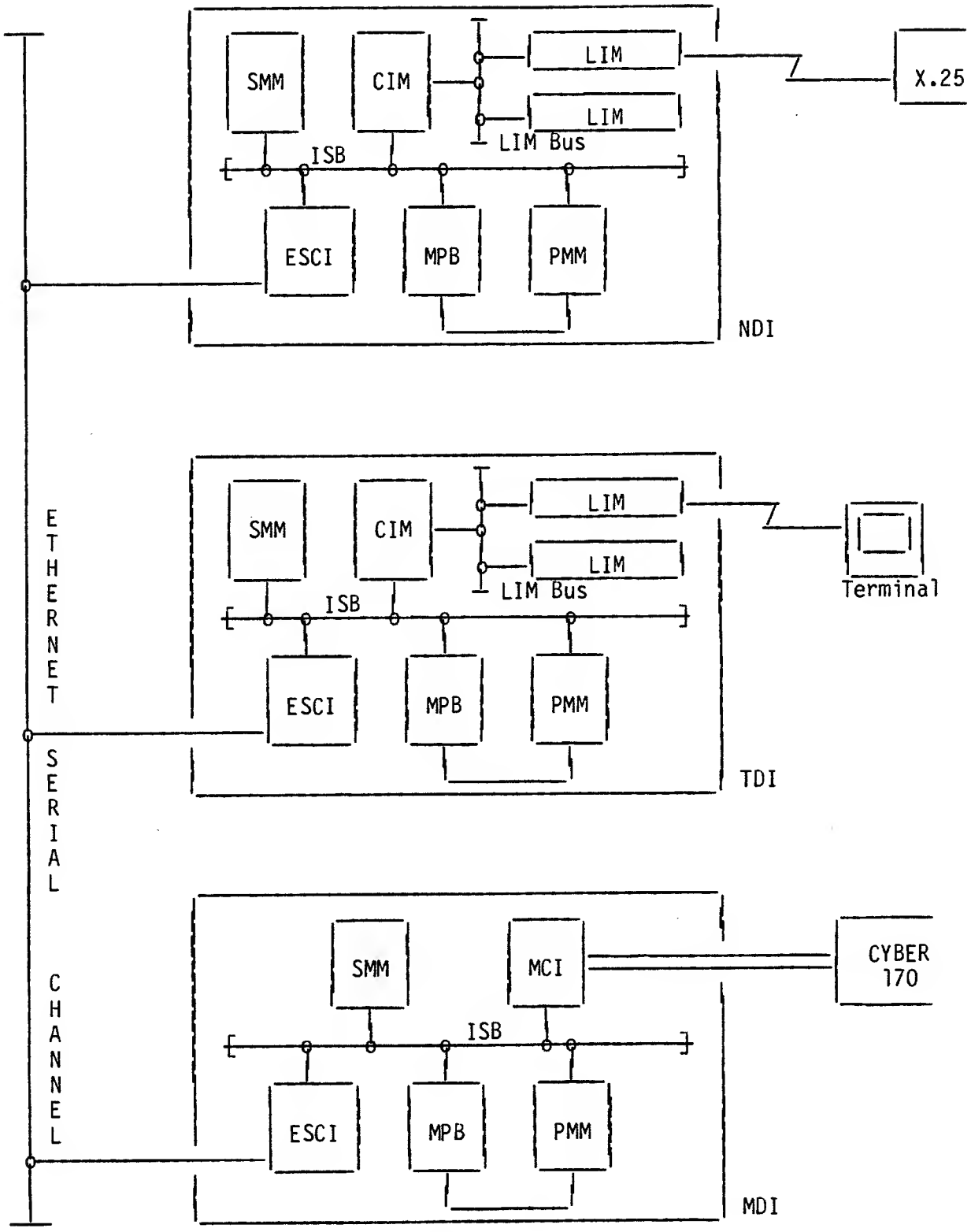
Provides Terminal connections to CDCNET

- MPB Main Processor Board
- SMM System Memory Module
- ESCI Ethernet Serial Channel Interface
- CIM Communications Interface Module
- LIM Line Interface Module(s)

NDI Network Device Interface

Provides External Network Connections to CDCNET

- MPB Main Processor Board
- SMM System Memory Module
- ESCI Ethernet Serial Channel Interface
- CIM Communications Interface Module
- LIM Line Interface Module(s)



Generic CDCNET Hardware Configuration

CDCNET Software Components

Interface Components

ASYNC TIP

Asynchronous Terminal Interface Program

Provides Terminal Control and Interface

(e.g. character conversion, page wait)

IVT Gateway

Interactive Virtual Terminal Gateway

Provides Interface to CYBER Interactive Services

Transformation between CDCNET and CYBER Formats

X.25 Gateway

Provides Interface to X.25 Packet Networks

(e.g. TELENET, TYMNET)

CDCNET Software Components

Upper/Core Layer Components

CDNA Session Layer

- Implements OSI Layer 5
- Based upon NBS Session Standard
- Provides Named, Network-Independent Services

Generic Transport

- Not Technically an OSI Layer
- Provides Standard Transport Interface for Multiple Protocols
- Resides Between Session and any Real Transport Layer

Xerox Transport

- Implements OSI Layer 4
- Xerox Ethernet Transport
- Provides reliable, ordered data connections

CDNA Internet 3B

- Implements part of OSI Layer 3
- Routes Messages between Concatenated Networks

CDNA Generic Intranet

- Not Technically a Layer, resides between 3A and 3B
- Provides Standard Interface for Multiple Network Solutions

CDCNET Software Components
Network Solution Layer Components

Ethernet Network Solution

ESCI 3A
- Implements part of OSI Layer 3
- Xerox Ethernet Protocol
- Provides Packet Delivery to Directly-Connected Nodes

ESCI SSR
- Implements OSI Layer 2
- Xerox Ethernet Protocol
- Ethernet Stream Service Routine

ESCI Driver
- Implements OSI Layers 2/1
- Firmware to Control ESCI Board

X.25 Network Solution

X.25 Packet Level
- Implements part of OSI Layer 3
- CCITT X.25 Packet Layer Standard
- Provides Packet Delivery to Directly-Connected Nodes

HDLC SSR
- Implements OSI Layer 2
- CCITT High-Level Data Link Control Protocol Standard
- HDLC Stream Service Routine

CDCNET Software Components

Network Management-Entities (M-Es)

Routing

Exchanges Routine Information with other DIs

Directory

Exchanges names of available protocols and services with other DIs

File Access

Provides DI access to mainframe-resident disk files

Command

Routes and Executes operator and terminal user commands

Log

Processes and Routes log messages to mainframe and/or operator

Alarm

Processes and Routes alarm messages to mainframe and/or operator

Clock

Synchronizes and maintains DI-resident clocks

Echo

Provides common echo source for diagnostic uses

Error

Processes network errors and generates appropriate log messages

CDCNET Software Components

Base System Software

Executive

- CPU Scheduling
- Buffer Management
- Inter-task Messages

Device Manager

- Common Software Interface for External Boards (e.g. ESCI, MCI)

Configuration Procurer

- Reads DI configuration from mainframe and obtains necessary software

Online Loader

- Obtains software requested on-line (e.g. by command) from mainframe

System Ancestor

Common Subroutines

Initial Loader

Command Parser

Command Processors

Diagnostics

CDCNET Software Components
CYBER Resident Components

Network Access Method (NAM)
- C170-based Network System
- Primarily Terminal Oriented
- Supports A-A Connections Also
- NVF Network Validation Facility
- PIP Peripheral Interface Program (2550 Interface)
- NS Network Supervisor (2550 load/dump)
- CS Communications Supervisor (2550 terminal/line monitor)

Interactive Facility (IAF)
- Interactive Job Interface to NOS
- NAM Application

Permanent File/Queued File Transfer Facility (PTF/QTF)
- Permanent File Transfers
- Job and Print File Transfers
- Supports inter-CYBER, also VAX and IBM

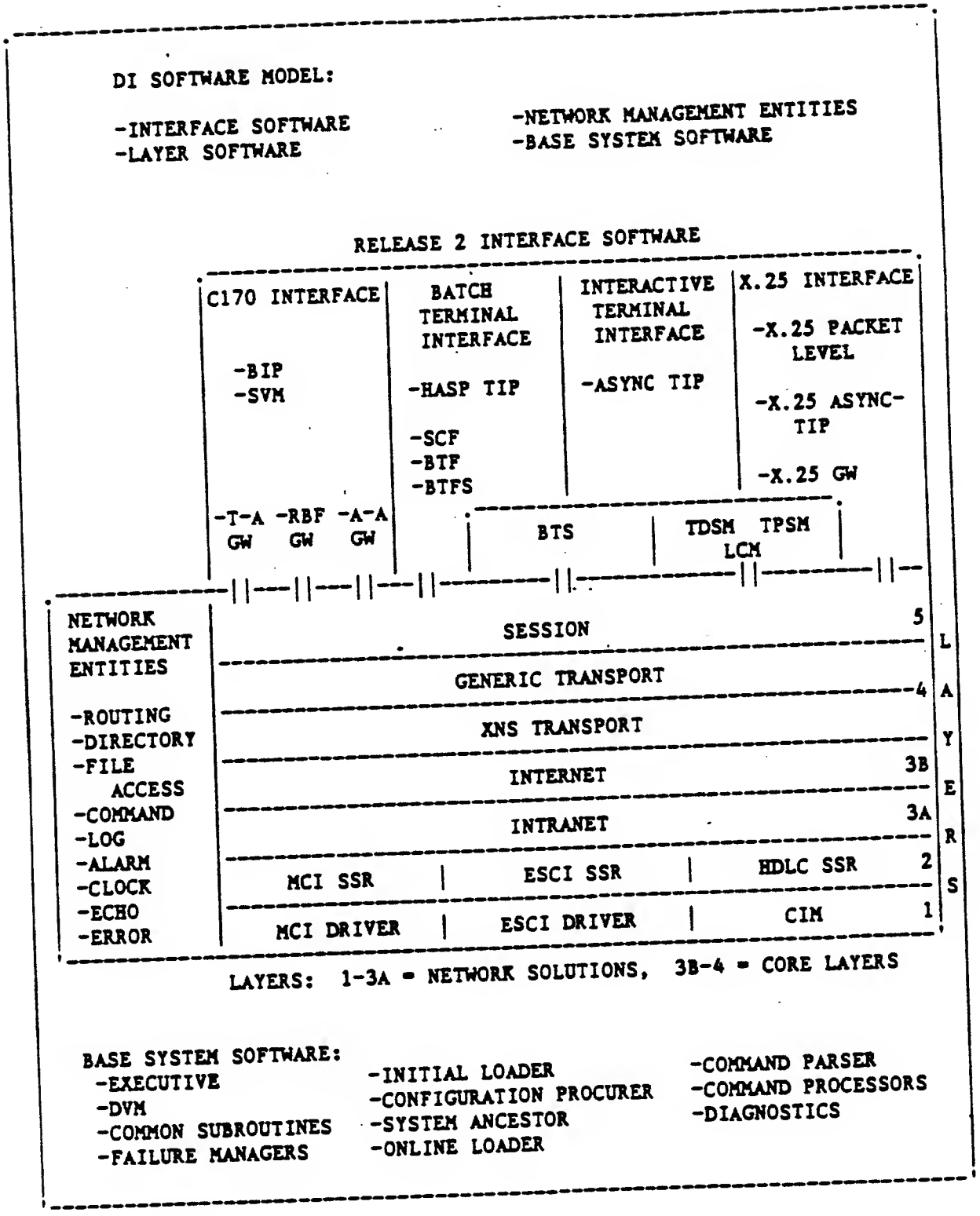
Network Operations Facility (NOF)
- Operator Interface to CDCNET
- CDCNET Command Entry
- CDCNET Log and Alarm Display

Network File Manager/Server (NETFM/NETFS)
- CDCNET File Server for CYBER 170
- Manages File Directory (CDCNET designed for NOS/VE World)
- NAM Application

INITMDI MDI Initialization
MANCC Manage CDCNET Configuration

DI SOFTWARE MODEL:

-INTERFACE SOFTWARE
-LAYER SOFTWARE
-NETWORK MANAGEMENT ENTITIES
-BASE SYSTEM SOFTWARE

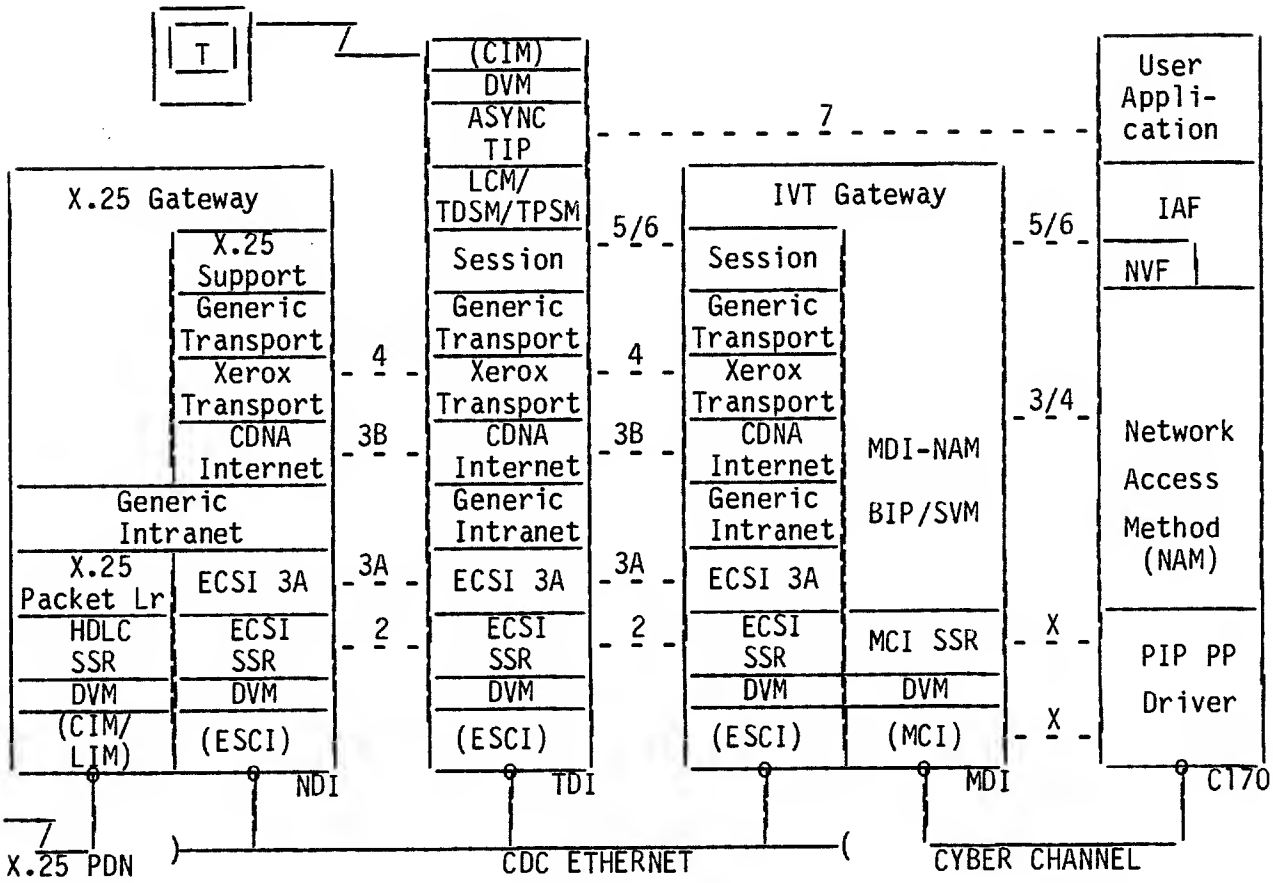


LAYERS: 1-3A = NETWORK SOLUTIONS, 3B-4 = CORE LAYERS

BASE SYSTEM SOFTWARE:

-EXECUTIVE
-DVM
-COMMON SUBROUTINES
-FAILURE MANAGERS
-INITIAL LOADER
-CONFIGURATION PROCURER
-SYSTEM ANCESTOR
-ONLINE LOADER
-COMMAND PARSER
-COMMAND PROCESSORS
-DIAGNOSTICS

KEY: - - - n - - - - Peer Protocol Interface at Network Layer n
——————— Direct Interface
(vertical line) No Interface



CDCNET Software Components

CYBER Host Implementation of DDN

X.25 Network Solution

1 Physical	RS-449, Connecting to DCE, 56000 Bits-per-second Connected to Modem Link via Phone Line to C/30 at TYMSHARE in Cupertino Implemented in LIM (NDI) Standard CDCNET
2 Data Link	HDLC/LAPB Implemented in CIM (NDI) Standard CDCNET
3a Network	X.25 Packet Level Only Used Point-to-Point Between NDI and C/30 Implemented in NDI Standard CDCNET with Enhancements Special DDN 'Facility' called DDN Basic X.25

CYBER Host Implementation of DDN

List of CPCIs

DCNS	Standard CDCNET
NOS	Standard NOS 2.4.3
X.25	X.25 Modifications
IP	Internet Protocol
IPSR	IP Static Routing
TCP	Transmission Control Protocol
EGP	Exterior Gateway Protocol
TELNET	Terminal Interface
	TELNET Interface
	Server TELNET Gateway
	User TELNET Gateway
DOD G/W	DOD/170 Gateway
	DOD Network Products Gateway
	DOD CYBER 170 Interface
FTP	File Transfer Protocol
SMTP	Simple Mail Transfer Protocol
NOS Mods	NOS Modifications

DDN CYBER Host Implementation
CPCI Summaries

X.25 Modifications
- Small Enhancements to Support 'DDN Standard X.25'
- No Work Done

Internet Protocol
- Implements DDN IP
- Resides in Both NDI and MDI
- Uses CDNA Generic Intranet for Interface to Network Solution
- Supports both Ethernet and X.25 Network Solutions
- Complete through Detailed Design

Internet Protocol Static Routing
- Supplies Host and Network Routing Information for IP
- Table Initialized by CDCNET Configuration Commands
- Complete through Detailed Design

Exterior Gateway Protocol
- Keeps IP Routing Tables Up-to-Date
- Exchanges Network (not host) Routing Information with DDN
- Resides in NDI
- No Work Done

Transmission Control Protocol
- Computes and Maintains Checksums on Data Blocks
- Maintains Acknowlegement Windows
- Provides End-to-End Flow Control
- Re-orders Packets into Original Order
- Header Includes checksum, window information, packet number
- Data is Byte-Stream Oriented (not message oriented)
- Resides in NDI and MDI
- Complete through Detailed Design

DDN CYBER Host Implementation

CPCI Summaries

TELNET Interface

- Provides Subroutine Interface for TELNET Protocol
- Functions include
  - Interrupt Process
  - Erase Character
  - Erase Line
  - Abort Output
  - Are You There
  - Binary Mode
  - Go Ahead/Suppress Go Ahead
- Resides in NDI and MDI
- Complete through Detailed Design

Server TELNET Gateway

- Provides DDN Terminal Access to CYBER
- Transformations between TELNET and VTP/IVT Protocols
- VTP (Virtual Terminal Protocol) - CDCNET Terminal Protocol
- IVT (Interactive Virtual Terminal Protocol - NP Protocol
- Resides in MDI

User TELNET Gateway

- Provides CDCNET Terminal Access to DDN
- Transformations between TELNET and VTP/IVT Protocols
- VTP (Virtual Terminal Protocol) - CDCNET Terminal Protocol
- IVT (Interactive Virtual Terminal Protocol - NP Protocol
- Resides in NDI

DDN CYBER Host Implementation
CPCI Summaries

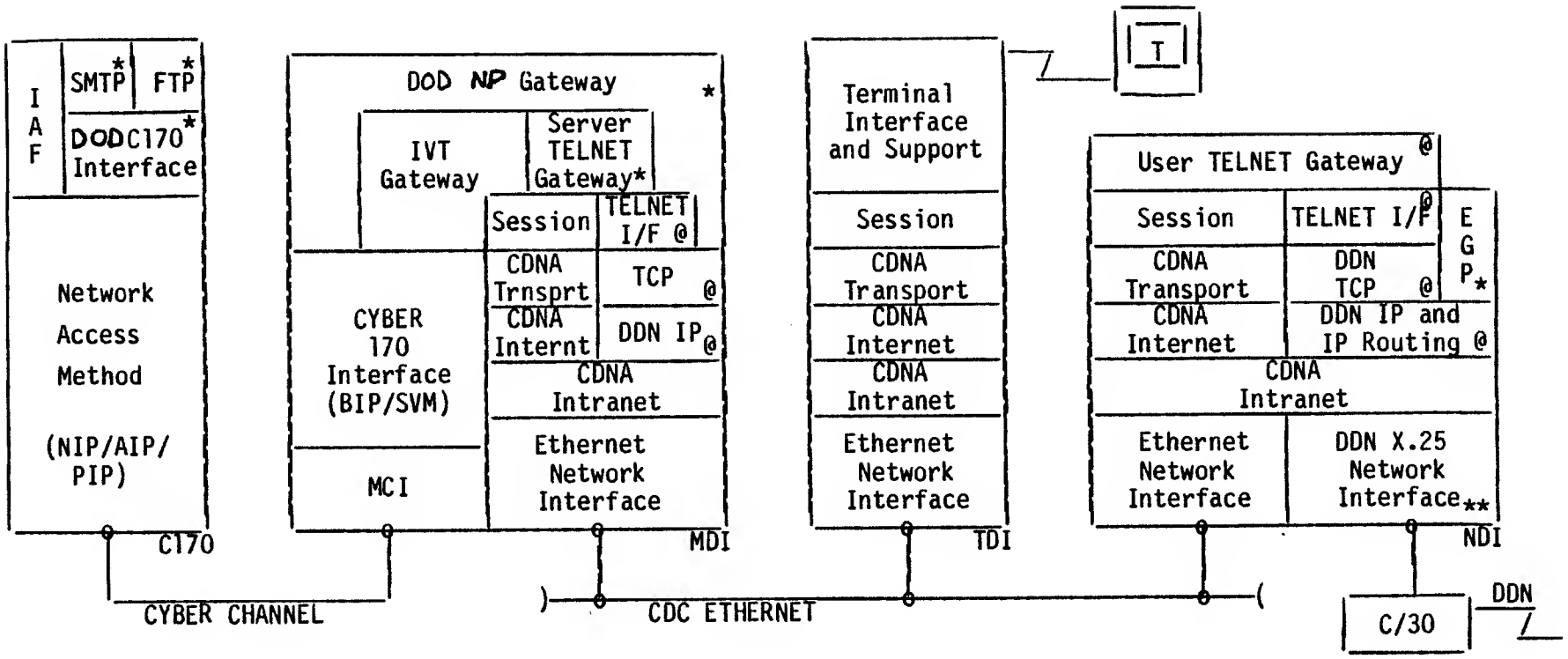
DOD Network Products Gateway
- Provides 170 Access to DDN TCP, IP, and TELNET
- Resides in MDI
- Communicates with DOD 170 Interface using NAM

DOD CYBER 170 Interface
- Subroutines to provide 170 applications with DDN services
- Resides in 170, in each application
- Communicates with DOD NP G/W in MDI using NAM

File Transfer Protocol
- Transfers Files Between Computers
- Support ASCII and Binary Files
- Supports Restart if Failure mid-stream
- Text Compression
- Accesses DDN via DOD Gateway
- Resides in CYBER

Simple Mail Transfer Protocol
- Transfers Mail Messages Between Computers
- ASCII Text Files
- Rudimentary User Interface
- Supports Mail Servers (e.g. SSDF MAIL)
- Accesses DDN via DOD Gateway
- Resides in CYBER

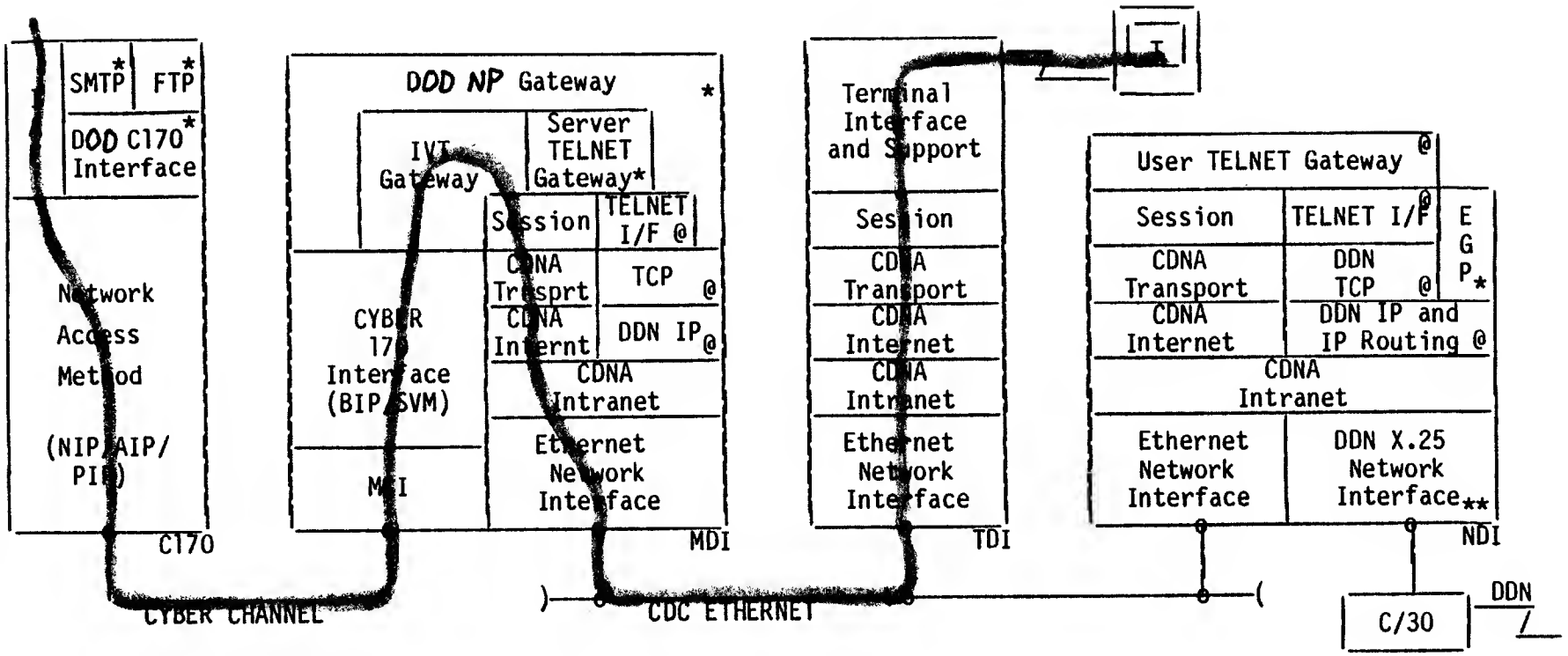
NOS Mods
- Changes to NOS Tables to Support FTP/SMTP/170 Interface
- Changes to QTRM to Support CYBER Applications
- Small Changes



@ Developed by CSU and
* Developed by ISD
** Standard DCNS Modified by ISD
none Standard DCNS or NOS

DDN CYBER Host Interface Components

CDCNET Terminal Access to NOS (Standard CDCNET)

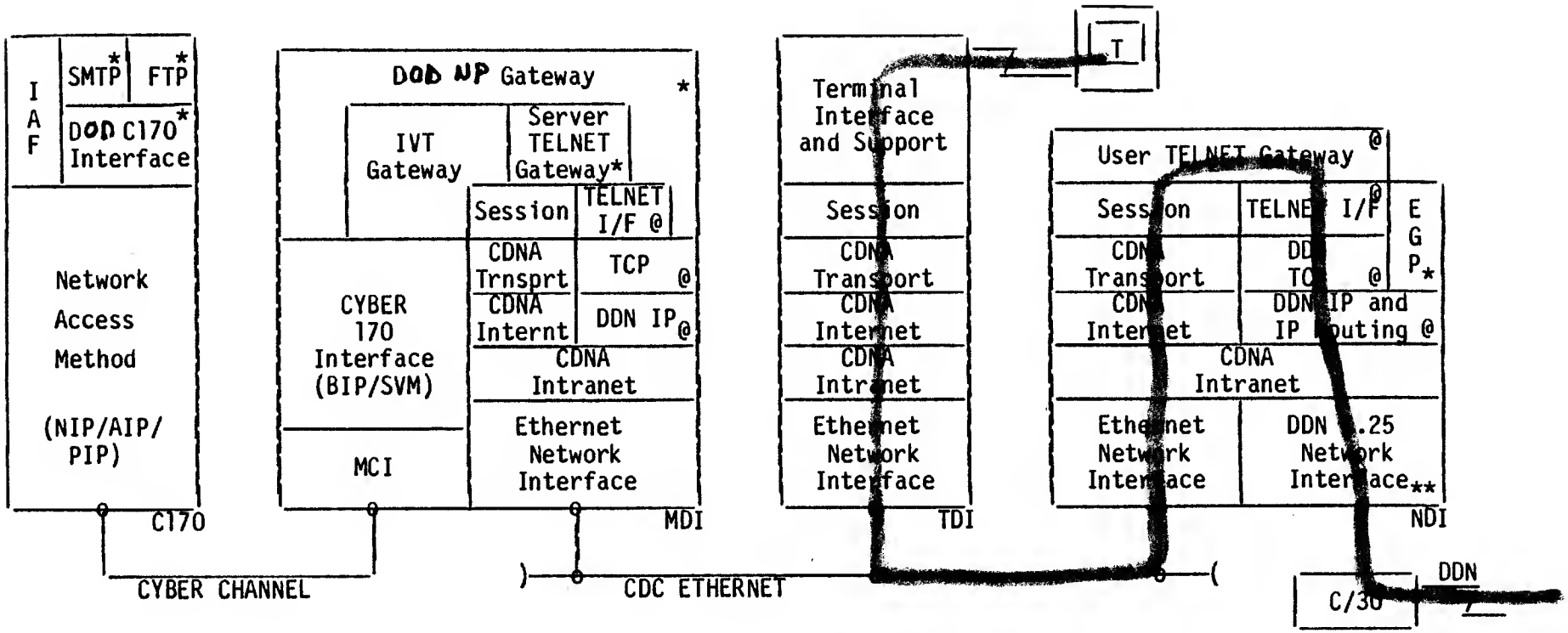


@ Developed by CSU
* Developed by ISD
** Standard DCNS Modified by ISD
none Standard DCNS or NOS

Data Flow, CDCNET Terminal Access to NOS

DDN CYBER Host Interface Components

CDCNET Terminal Access to DDN (User TELNET)

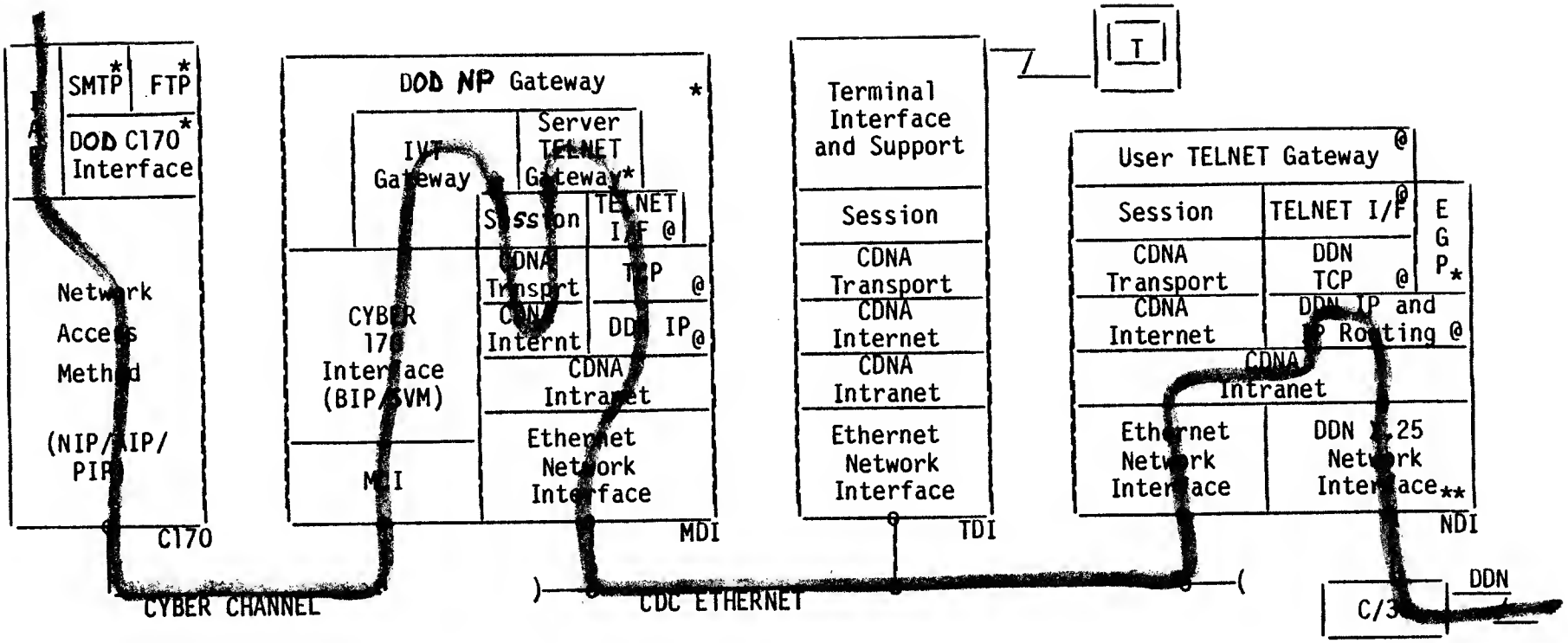


@ Developed by CSU
* Developed by ISD
** Standard DCNS Modified by ISD
none Standard DCNS or NOS

Data Flow, CDCNET Terminal Access to DDN

DDN CYBER Host Interface Components

DDN Terminal Access to NOS (User TELNET)

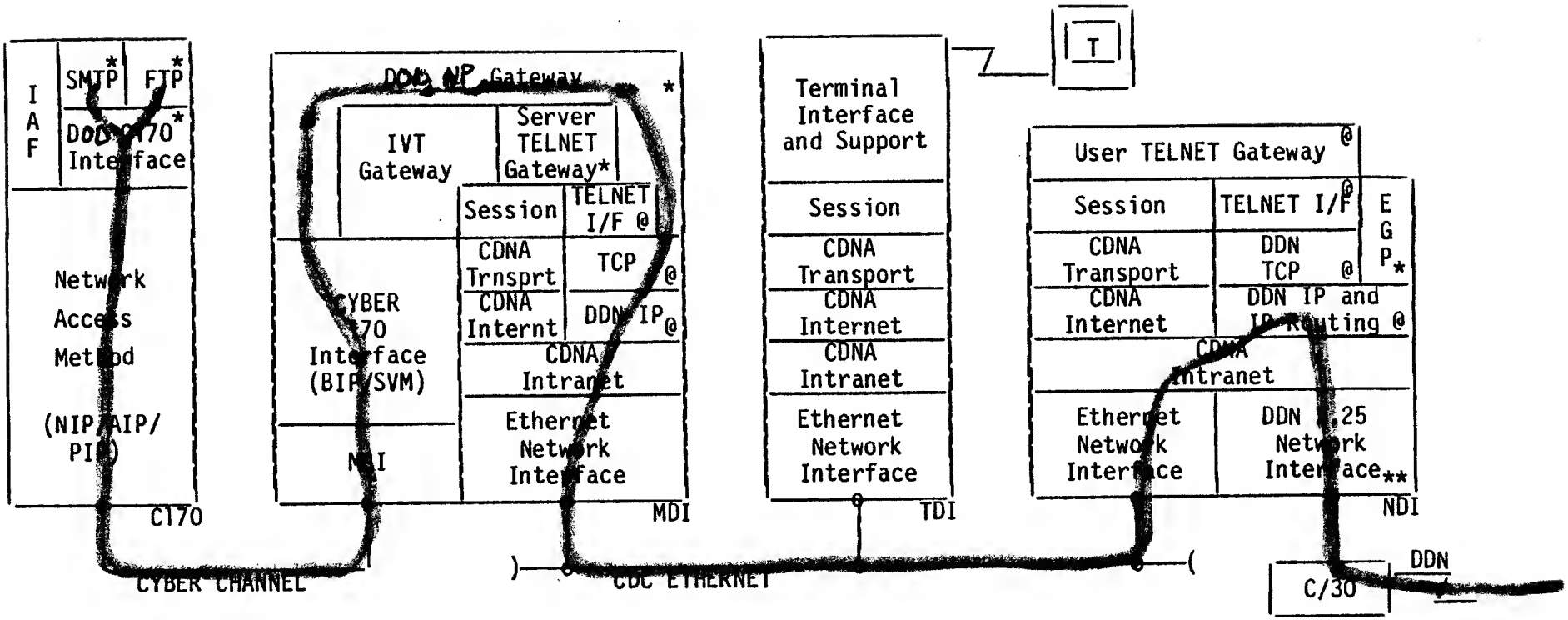


@ Developed by CSU
* Developed by ISD
** Standard DCNS Modified by ISD
none Standard DCNS or NOS

Data Flow, DDN Terminal Access to NOS

DDN CYBER Host Interface Components

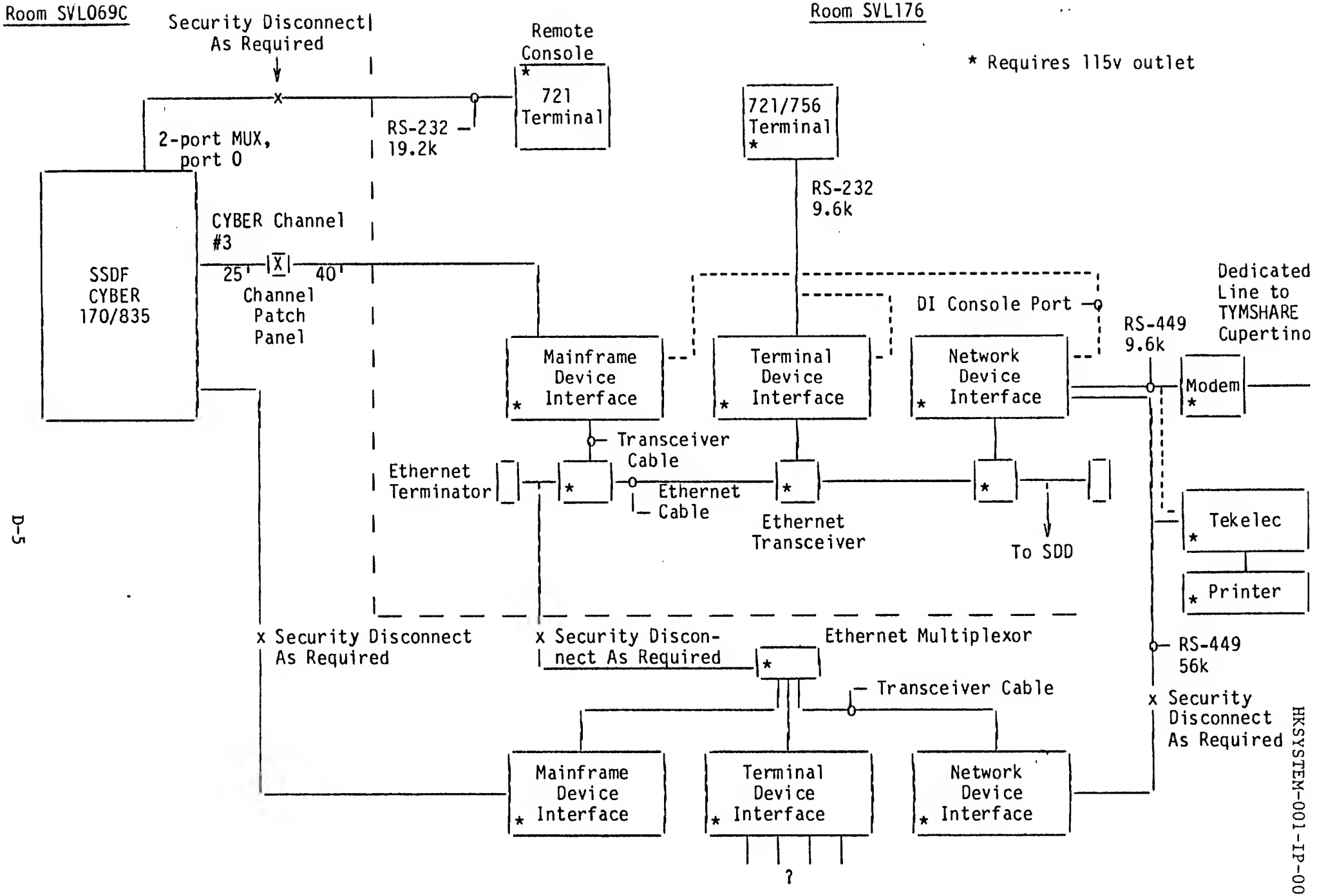
Mail and File Access Between NOS and DDN (FTP,SMTP)



@ Developed by CSU
* Developed by ISD
** Standard DCNS Modified by ISD
none Standard DCNS or NOS

Data Flow, Mail and File Application Access to/from DDN

DDN CYBER Host Interface Components



Ultimate DDN Configuration, ISD Sunnyvale

HKSYSTEM-001-IP-00-A

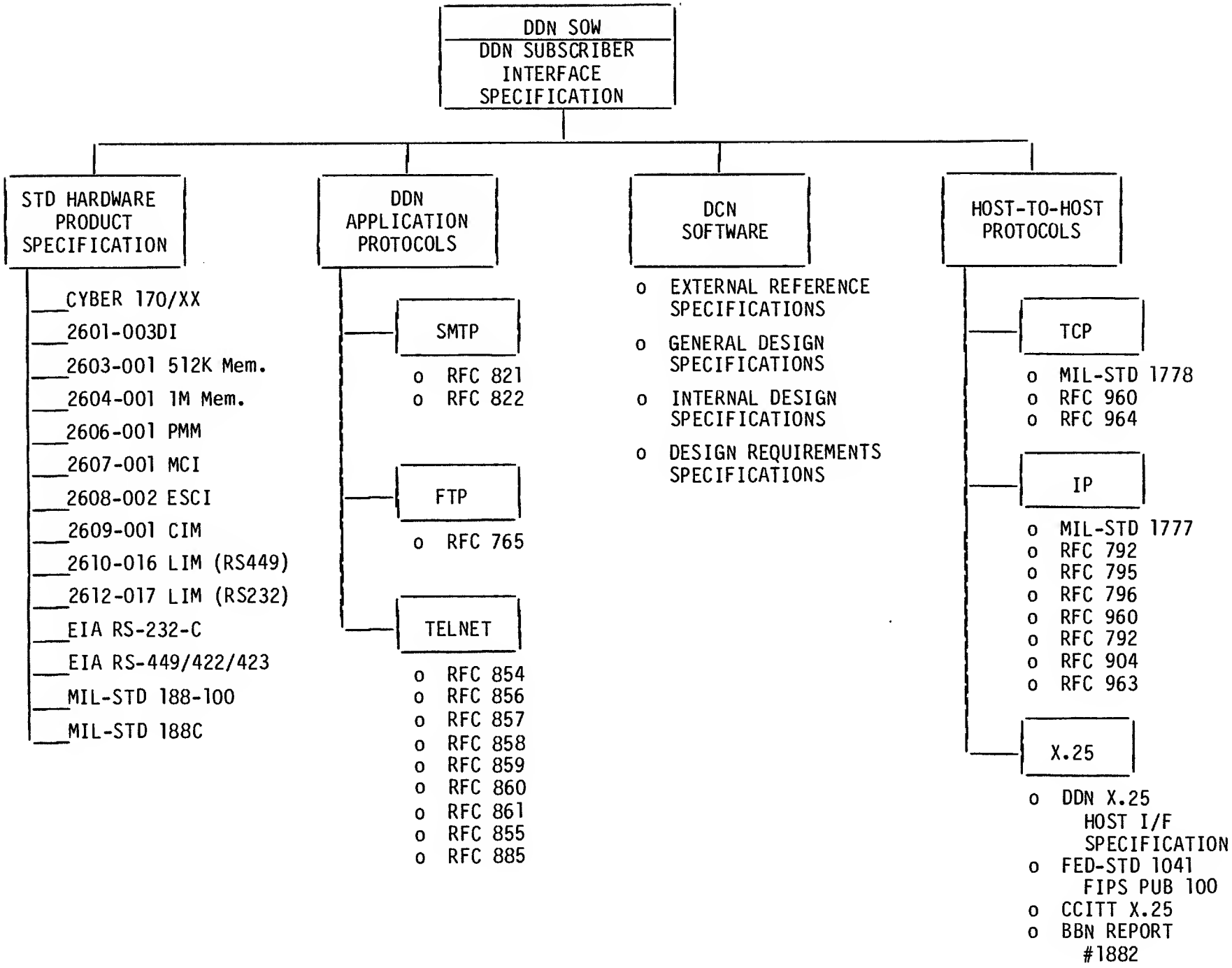


Figure 2.1-1. DDN Specification Tree